

SECTION 16120 WIRES AND CABLES

PART 1 GENERAL

1.01 SUMMARY

This Section includes building wires and cables and associated splices, connectors, and terminations for wiring systems rated 600 volts and less.

1.02 SUBMITTALS

- A. General: Submit to the Architect the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Field test reports indicating and interpreting test results relative to compliance with performance requirements of testing standard.

1.03 QUALITY ASSURANCE

- A. Testing Firm Qualifications: In addition to the requirements specified in Division 1 Section "Quality Control Services," an independent testing firm shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or shall be a full member company of the International Electrical Testing Association (NETA).
 - 1. Testing Firm's Field Supervisor Qualifications: A person currently certified by the NETA National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Comply with NFPA 70 "National Electrical Code" for components and installation.
- C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed and Labeled": As defined in the "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.04 SEQUENCING AND SCHEDULING

- A. Coordination: Coordinate layout and installation of cable with other installations.
 - 1. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Architect.

1.05 DELIVERY, STORAGE, AND HANDLING

Deliver wire and cable according to NEMA WC-26.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - 1. Wires and Cables:
 - a. Southwire Co.
 - b. The Okonite Co.
 - c. HWC Wire & Cable.
 - 2. Connectors for Wires and Cables:
 - a. AMP, Inc.
 - b. Anderson, Square D Co.
 - c. Electrical Products Division, 3M Co.
 - d. O-Z/Gedney Unit, General Signal.

2.02 BUILDING WIRES AND CABLES

- A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Applications" Article.
- B. Rubber Insulation: Conform to NEMA WC 3.
- C. Thermoplastic Insulation: Conform to NEMA WC 5.
- D. Cross-Linked Polyethylene Insulation: Conform to NEMA WC 7.
- E. Ethylene Propylene Rubber Insulation: Conform to NEMA WC 8.
- F. Solid conductor for 10 AWG and smaller; stranded conductor for larger than 10 AWG, unless otherwise noted on drawings.
- G. Not acceptable – Romex, NM/NMC, MC cable.

2.03 CONNECTORS AND SPLICES

UL-listed factory-fabricated wiring connectors of size, ampacity rating, material, and type and class for application and for service indicated. Select to comply with Project's installation requirements and as specified in Part 3 "Applications" Article.

2.04 ALTERNATE WIRING SYSTEM

- A. Manufactured wiring system as manufactured by Reloc, Electro-Connect or approved equal.
- B. Manufactured wiring system (alternate) to meet requirements of U.L. Standard 183 and Article 604 of the National Electric Code.
 - 1. Rated for use on 20-amp branch circuits.
 - 2. Pin and socket contacts.
 - 3. All branch circuit conductors are No. 12 AWG stranded copper with 90 degree C. thermoplastic insulation rated at 600 volts.
 - 4. Color coding rapidly identifies system voltages.
 - 5. One, two or three hot conductors with a common neutral and ground conductor available in each cable.
 - 6. Fully rated grounding conductor.

PART 3 EXECUTION

3.01 EXAMINATION

Examine raceways and building finishes to receive wires and cables for compliance with installation tolerances and other conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

- A. Service Entrance: Type RHW or THWN, copper conductor, in raceway.
- B. Feeders: Type THHN/THWN, copper conductor, in raceway.
- C. Branch Circuits: Type THHN/THWN, copper conductor, in raceway.
- D. Class 1 Control Circuits: Type THHN/THWN, copper conductor, in raceway.

- E. Class 2 Control Circuits: Type THHN/THWN, copper conductor, in raceway.

3.03 CONDUCTOR SIZE

- A. Minimum conductor size for power and lighting circuits shall be #12 unless otherwise noted. Where a conductor size is called out on the Drawings for a home run, the same conductor size shall be used for all wiring throughout the entire circuit.

3.04 INSTALLATION

- A. Install wires and cables as indicated, according to manufacturer's written instructions and the NECA "Standard of Installation."
- B. Remove existing wire from raceway before pulling in new wire and cable.
- C. Pull conductors into raceway simultaneously where more than one is being installed in same raceway.
 - 1. Use pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation.
 - 2. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.
- D. Install exposed cable, parallel and perpendicular to surfaces or exposed structural members, and follow surface contours where possible.
- E. Conductor Splices: Keep to minimum.
 - 1. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
 - 2. Use splice and tap connectors that are compatible with conductor material.
- F. Wiring at Outlets: Install with at least 12 inches (300 mm) of slack conductor at each outlet.
- G. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL Standard 486A.

3.05 COLOR CODING AND LABELING

- A. All wiring #8 AWG and smaller for its entire length shall be color coded as follows:

120/208V

277/480V

Phase A	Black	Brown
Phase B	Red	Orange
Phase C	Blue	Yellow
Neutral	White	White with Gray Stripe
Ground	Green	Green
Isolated Ground		Green with Yellow Stripe

For large conductors not generally furnished with colored insulation, identification shall be achieved by the use of plastic tape or sleeves of the appropriate color.

1. All conductors of the same phase shall have the same color throughout the installation.
 2. The grounded conductor shall be identified by white colored insulation.
- B. Conductor Tagging: Tag conductors at switches, receptacles, motor controls, panels, terminal cabinets and junction boxes with premarked plastic type, Brady "Quicklabels". Tag circuits to agree with panel directory circuit number. Tag circuits which pass through other devices, i.e., "E-12 Exterior Light Relay", etc.

3.06 FIELD QUALITY CONTROL

- A. Testing: Upon installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA Standard ATS, Section 7.3.1. Certify compliance with test parameters.
- B. Correct malfunctioning products at site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.

END OF SECTION

SECTION 16140 WIRES DEVICES

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes various types of receptacles, connectors, switches, and finish plates.

1.02 SUBMITTALS

- A. Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for each product specified.
- C. Operation and maintenance data for materials and products specified in this Section to include in the "Operating and Maintenance Manual" specified in Division 1.

1.03 QUALITY ASSURANCE

- A. Comply with NFPA 70 "National Electrical Code" for devices and installation.
- B. Listing and Labeling: Provide products that are listed and labeled for their applications and installation conditions and for the environments in which installed.
 - 1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.04 COORDINATION

- A. Wiring Devices for Owner Furnished Equipment: Match devices to plug connectors for Owner-furnished equipment.
- B. Cord and Plug Sets: Match cord and plug sets to equipment requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Wiring Devices:

- a. Arrow Hart Div., Cooper Industries.
- b. Bryant Electric, Inc.
- c. General Electric Co.
- d. Hubbell Inc.
- e. Killark Electrical Mfg. Co.
- f. Leviton Mfg. Co., Inc.
- g. Pass & Seymour/Legrand.

2. Multi-Outlet Assemblies:

- a. Kellems Div., Hubbell, Inc.
- b. Wiremold Co.

2.02 WIRING DEVICES

- A. Comply with NEMA Standard WD 1, "General Purpose Wiring Devices."
- B. Enclosures: NEMA 1 equivalent, except as otherwise indicated.
- C. Color: White except as otherwise indicated or required by Code.
- D. Receptacles, Straight-Blade and Locking Type: Except as otherwise indicated, comply with Federal Specification W-C-596 and heavy-duty grade of UL Standard 498, "Electrical Attachment Plugs and Receptacles." Provide NRTL labeling of devices to verify these compliances.
- E. Receptacles, Straight-Blade, Special Features: Comply with the basic requirements specified above for straight-blade receptacles of the class and type indicated, and with the following additional requirements:
- 1. Ground-Fault Circuit Interrupter (GFCI) Receptacles: UL Standard 943, "Ground Fault Circuit Interrupters," feed-through type, with integral NEMA 5-20R duplex receptacle arranged to protect connected downstream receptacles on the same circuit. Design units for installation in a 2-3/4-inch (70-mm) deep outlet box without an adapter.
 - 2. Isolated Ground Receptacles: Equipment grounding contacts are connected only to the green grounding screw terminal of the device and have inherent electrical isolation from the mounting strap.

- a. Devices: Listed and labeled as isolated ground receptacles (orange color).
 - b. Isolation Method: Integral to the receptacle construction and not dependent on removable parts.
- F. Cord and Plug Sets: Match voltage and current ratings and number of conductors to requirements of the equipment being connected.
 - 1. Cord: Rubber-insulated, stranded copper conductors, with type SOW-A jacket. Grounding conductor has green insulation.
 - 2. Plug: Male configuration with nylon body and integral cable-clamping jaws. Match to cord and to receptacle type intended for connection.
- G. Snap Switches: Specification Grade, quiet-type a.c. switches, NRTL listed and labeled as complying with UL Standard 20 "General Use Snap Switches," and with Federal Specification W-S-896.
 - 1. Rating: 20 amp, 120-277 volt.
- H. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permits separate or common feed connection.
 - 1. Switch: 20 ampere, 120-277 V a.c.
 - 2. Receptacle: NEMA configuration 5-20R.
- I. Timer Switch: Programmable electronic 365 day programming battery back-up. Paragon EC74 or equivalent.
- J. Wall Plates: Single and combination types that mate and match with corresponding wiring devices. Features include the following:
 - 1. Plate-Securing Screws: Metal with heads colored to match plate finish.
 - 2. Provide white plastic plates, non-combustible, mar-resistant thermosetting plastic 0.100" thick and of plain style by P & S, Sierra Series or equal. Devices shall match the plates. Weatherproof receptacle plates shall be P & S #4504.
- K. Flush Floor Outlets:
 - 1. Flush floor outlets shall consist of a NEMA 5-20R duplex receptacle installed in a fully adjustable (before and after concrete pour) formed steel box with brass flange ring and brass duplex flap cover plates.
 - 2. Manufacturer: Hubbell

- a. #B2529, Box.
- b. #S-3925, Cover Plate.
- c. #S-3079, Flange Ring.
- d. Or approved equal.

2.03 MULTI-OUTLET ASSEMBLIES

- A. Comply with Standard UL 5, "Surface Metal Raceways and Fittings."
- B. Components of Assemblies: Products of a single manufacturer designed to be used together to provide a complete matching assembly of raceways and receptacles.
- C. Raceway Material: Metal, with manufacturer's standard corrosion-resistant finish.
- D. Wire: No. 12 AWG.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install devices and assemblies plumb and secure.
- B. Install wall plates when painting is complete.
- C. Arrangement of Devices: Except as otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- D. Protect devices and assemblies during painting.
- E. Devices mounted in a common wall shall be offset horizontally, minimum of 12" or mounted in adjacent stud spaces.

3.02 IDENTIFICATION

Switches: Where 3 or more switches are ganged, and elsewhere where indicated, identify each switch with approved legend engraved on wall plate.

3.03 GROUNDING

Isolated Ground Receptacles: Connect to isolated grounding conductor routed to designated isolated equipment ground terminal of electrical system.

3.04 FIELD QUALITY CONTROL

- A. Testing: Test wiring devices for proper polarity and ground continuity. Operate each operable device at least 6 times.
- B. Test ground-fault circuit interrupter operation with both local and remote fault simulations according to manufacturer recommendations.
- C. Replace damaged or defective components.

3.05 CLEANING

General: Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION

